



## Diagnosing rupture of the cranial cruciate ligament

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**T**he most common orthopedic injury in the dog can pose its share of diagnostic challenges. Rupture of the cranial cruciate ligament (CCL) can present either as an acute lameness with the characteristic

“toe-touching” gait or as a chronic lameness that was pronounced initially, improved with rest, but never completely resolved (1,2).

The orthopedic examination should begin by approaching the standing animal from behind. The comparative girth of the quadriceps femoris musculature and the stifle should be noted. In chronic rupture of the CCL, the circumference of the quadriceps muscle may be decreased appreciably. In chronic, and even relatively acute, cruciate tears, a general increase in the thickness of the stifle will be noted. The left and right patellar tendons should be palpated simultaneously from behind the animal; starting at the patella, the thumb and index finger of each hand are run down the length of the patellar tendon. In the normal dog, the distinct edges of the tendon can be palpated easily, and a slight depression can be appreciated lateral to the lateral edge and medial to the medial edge of the tendon. In the limb with the ruptured CCL, the edges of the tendon will be less distinct than in the normal limb and the slight depressions may be absent. These changes are due to joint effusion and periarticular fibrosis. This palpation technique will also permit the detection of the “medial buttress,” a fibrotic thickening on the medial aspect of the stifle joint that is characteristic of chronic tears of the CCL.

Definitive diagnosis of rupture of the CCL demands an assessment of stifle joint stability by means of the cranial “drawer” test, the tibial compression test, or both tests. The cranial drawer assessment is best done on the laterally recumbent animal. The examiner stands behind the dog and places a thumb on the caudal aspect of the femoral condylar region with the index finger on the patella. The other thumb is placed on the head of the fibula with the index finger on the tibial crest. The ability to move the tibia forward (cranially) with respect to a fixed femur is a positive cranial drawer sign indicative of a CCL rupture. Comparing the affected stifle with the normal stifle provides a ready frame of reference. The

examiner must be sure to have a firm hold of bone and to test for the drawer sign through the stifle’s entire range of motion. Attempting to produce the cranial drawer sign with the stifle in extension will frequently elicit a painful response in a dog with a CCL injury, although the drawer motion is most often detected with the stifle flexed. An agitated dog with plenty of quadriceps muscle tone can make detection of the drawer sign a challenge. Sedation or general anesthesia may be necessary (1,3).

Evaluation of the cranial thrust of the tibia via the tibial compression test is another useful way of assessing stifle stability. This can be accomplished in the standing or recumbent animal. With the stifle in a standing angle, the examiner grasps the pes and flexes the hock joint. In the animal with a normal gastrocnemius-calcaneal tendon mechanism, hock flexion produces a distally-directed force vector from the origin of the gastrocnemius muscle at the caudal aspect of the femoral condyles. This tightens the CCL, if it is intact. If it is not, the downward force of the femoral condyles pushes the proximal end of the tibia cranial. By placing the base of the index finger over the patella and the fingertip on the tibial crest, this cranial movement can be detected. The tibial compression test has the advantage that it can be done in the standing animal, which is especially helpful in large dogs. The disadvantage is that for many examiners, a positive tibial compression test is not detected as consistently as a cranial drawer sign (1). The ability to rotate the tibia medially with respect to the femur to a greater extent in the cruciate-deficient stifle than in the normal stifle has been suggested as an additional diagnostic test, since the CCL is a major restraint of inward tibial rotation in the dog. This test is not a reliable indicator of CCL integrity by itself, partly because several other structures affect the degree to which inward rotation of the tibia can be produced; these include the menisci, the lateral collateral ligament, and the periarticular musculature. If quadriceps femoris muscle tone and size is diminished due to any chronic lameness, the degree of inward tibial rotation that can be obtained is increased (1,2,4).

Radiographic evaluation of the stifle joint can be an aid in confirming the diagnosis. Osteoarthritic changes are a nonspecific and inconsistent finding in the cranial cruciate-deficient patient, and they are inevitably more severe when evaluated on exploratory arthrotomy than when observed on radiography. A triangle of increased radiographic lucency caudal to the patellar tendon on lateral projection of the stifle is associated with the infrapatellar fat pad, and it has been suggested as an

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indicator of cruciate disease. In the normal stifle, this area of lucency extends from the distal extent of the patella, proximally; to the tibial crest, distally; to the origins and insertions of the cruciate ligaments, caudally. Cruciate injury produces joint effusion and fibrous tissue that begins to obliterate this triangle, progressing from caudal to cranial as the fluid, fibrosis, or both, accumulate. However, detection of this change can be inconsistent, as it demands impeccable radiographic technique (2). The most reliable radiographic method of diagnosing cruciate disease is through the use of tibial compression radiography. By taking a lateral radiograph of the stifle while performing the tibial compression test, cranial displacement of the tibia with respect to the femur was demonstrated in 97% of subsequently confirmed ruptures of the CCL. Indeed, the sensitivity and specificity of this technique was superior to that of the cranial drawer test (5).

Several potential pitfalls exist in confirming a diagnosis when pathologic changes to the CCL are suspected. Some dogs may have concurrent rupture of the CCL and medial luxation of the patella (MPL). These 2 conditions can be interwoven, since many patients with an MPL have medial rotation of the tibial crest, which puts continuous tension on the CCL. This is thought to predispose to tearing of the CCL. In addition, chronic osteoarthritis, present in the stifles of dogs with MPL, produces an enzymatic environment that can lead to degradation of the CCL (4). Rupture of the CCL tends to make the degree of patellar luxation worse, because a restraint on inward rotation of the tibia has been lost and because cranial displacement of the tibia during weight bearing moves the insertion of the patellar tendon cranial, thus "lifting" the patella out of the trochlear groove and facilitating luxation. Before attributing a hind limb lameness to an MPL, however, it is wise to check the drawer sign and to remember that MPL is seldom a cause of acute lameness (6). Many dogs that were not lame due to their MPL before CCL rupture may require little or no surgical correction other than an extracapsular cruciate repair, lateral retinacular imbrication, or both.

Partial CCL tears appear to be ever more common. The history and physical examination of these patients dif-

fer little from those of the dog with a complete rupture, save for the fact that drawer motion may be minimal or absent. If present, drawer motion will be detected in partial or complete stifle flexion, because, in flexion, the craniomedial bundle of the normal CCL is in tension and resists the drawer motion. It is nearly always the craniomedial bundle that is affected in partial tear of the CCL. Diagnosis of partial tears demands greater attention to the other aspects of the examination of the stifle joint, especially detection of joint effusion and periarticular fibrosis.

Acute bilateral CCL ruptures can present a diagnostic challenge, since they may appear to be a neurologic condition, such as degenerative myelopathy or herniation of an intervertebral disc. These dogs have great difficulty rising and may appear to have hind limb paresis.

Other conditions that may cause "cruciate-like" lameness and joint changes include hemarthrosis, typically due to von Willebrand's disease but infrequently due to immune-mediated thrombocytopenia; anticoagulant rodenticide toxicosis or other causes of coagulopathy; neoplasia, including osteosarcoma (most often of the proximal end of the tibia); and synovial cell sarcoma or immune-mediated arthritides. Arthrocentesis, biopsy, or both may be important diagnostic aids in such cases (6).

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